What is Claimed Is:

Sub a1

1. A haploid fungal cell comprising a recombinant genome, the recombinant genome comprising a heterologous DNA functionally coupled to a recombination hotspot; the haploid fungal cell being capable of being converted to a diploid fungal cell; the heterologous DNA being adapted and configured within the recombinant genome for recombination in the diploid fungal cell.

2. The haploid fungal cell of claim 1, wherein the fungal cell is *Neurospora crassa*, *S. cerevisiae*, or *S. pombe*.

3. The haploid fungal cell of claim 1, wherein the haploid cell is a cell of a filamentous fungus, of a conidium or other asexual spore, an ascospore, zygospore, basidiospore or other sexual spore, mycelium, heterokaryon, dikaryon or homokaryon, or is a yeast cell.

4. The haploid fungal cell of claim 1, wherein the recombination hot spot is *Neurospora crassa cog*, 3' of *his-3* and 3' of *am* in *Neurospora crassa*, 3' of *his4* and 3' of *arg4* in *S. cerevisiae*, or within *ade6* in *S. pombe*.

5. The haploid fungal cell of claim 1, wherein the recombination hot spot is an allele of *Neurospora crassa cog*.

6. The haploid fungal cell of claim 5, wherein the recombination hot spot is *Neurospora crassa* cog^{L}.

7. The haploid fungal cell of claim 5, wherein the heterologous DNA is located between the *his-3* gene and *cog*.

8. The haploid fungal cell of claim 1, wherein the heterologous DNA is a promoter, is a regulatory sequence, is a noncoding sequence, encodes all or part of a subunit of an immunoglobulin, all or part of a heteromultimeric protein, all or part of a homomultimeric protein, all or part of a monomeric protein, all or part of a non-transcribed DNA sequence, all or part of a sequence that regulates the activity of a gene, all or part of a sequence transcribed into an RNA molecule lacking catalytic activity, all or part of a sequence transcribed into an RNA molecule having catalytic activity, or a combination thereof.

9. The haploid fungal cell of claim 1, wherein the fungal cell is *Neurospora crassa* of mating type *A* or type *a*.

10. A pair of haploid fungal cells according to claim 1, wherein each cell carries the same allele of the genetic loci that determine heterokaryon compatibility, whereby the progeny of crosses of the pair of cells can form heterokaryons in any combination of like mating type.

11. The pair of cells of claim 10, wherein each fungal cell is *Neurospora crassa* and each cell carries the same allele of the genetic loci *het-c, het-d, het-e, het-i, het -5, het-6, het-7, het-8, het-9*, and *het-10* .

12. The haploid fungal cell of claim 1, wherein the fungal cell comprises a forcing marker for a heterokaryon formed from the haploid cell.

13. The haploid fungal cell of claim 12, wherein the forcing marker comprises one or more auxotrophic mutations.

14. The haploid fungal cell of claim 13, wherein the forcing marker leads to a requirement for tryptophan, pantothenic acid, thiamine, or arginine.

15. The haploid fungal cell of claim 14, wherein the fungal cell is *Neurospora crassa* and the forcing marker is a mutation that inactivates a *trp-2* gene, a *pan-2* gene, a *thi* gene, or an *arg* gene.

16. The haploid fungal cell of claim 12, wherein the heterologous DNA codes for a subunit of a multisubunit protein.

17. A pair of haploid fungal cells according to claim 16, wherein each cell comprises a forcing marker for a heterokaryon formed from the haploid cell, and each forcing marker is the same.

18. The pair of haploid cells of claim 17, wherein the heterologous DNA encodes subunits of a protein having a more than one type of subunit.

19. A pair of haploid fungal cells according to claim 18, wherein each cell comprises a forcing marker for a heterokaryon formed from the haploid cell, and the forcing markers are different.

20. The pair of haploid cells of claim 19, wherein the heterologous DNA encodes subunits of a protein having a single type of subunit.

21. The haploid fungal cell of claim 1, wherein the fungal cell comprises a genetic characteristic that suppresses heterokaryon incompatibility between strains of different mating type to allow all combinations of progeny to form heterokaryons.

22. The haploid fungal cell of claim 21, wherein the fungal cell is *Neurospora crassa* and the cell carries the mutation *tol* , whereby heterokaryon incompatibility between strains of different mating type is suppressed.

23. The haploid fungal cell of claim 1, wherein the fungal cell is *Neurospora crassa* and the recombinant genome comprises an auxotrophic mutation in the *his-3*.

24. A pair of haploid fungal cells according to claim 1, wherein each fungal cell is *Neurospora crassa* and the pair cells comprise a non-complementing pair of *his-3* alleles.

25. The pair of haploid cells of claim 24, wherein the non-complementing pair is K26 and K480 whereby a heterokaryon carrying both alleles fails to grow on media lacking histidine.

26. The pair of haploid fungal cells of claim 24, wherein the fungal cell is *Neurospora crassa* and the cell carries cog^{L} and *lpl* sequences from the Lindegren strain.

27. The pair of haploid fungal cells of claim 24, wherein the fungal cell is *Neurospora crassa* and the cell carries *rec-2*.

28. The haploid fungal cell of claim 1, wherein the fungal cell is *Neurospora crassa* comprising a gene conferring resistance to an agent for selecting against the presence of the recombinant genome.

29. The haploid fungal cell of claim 28 wherein the agent is p-flurophenylalanine.

30. The haploid cell of claim 28, wherein the gene conferring resistance is *mtr*.

31. The haploid fungal cell of claim 1, wherein the fungal cell is *Neurospora crassa* comprising a mutant gene to limit growth on plating media.

32. The haploid fungal cell of claim 31, wherein the mutant gene is *cot-1* C102t.

33. The haploid fungal cell of claim 1, wherein the recombinant genome comprises DNA sequences to enhance production, secretion, or both of a protein encoded by the heterologous sequence.

34. A diploid fungal cell comprising a recombinant genome, the recombinant genome comprising a first heterologous DNA functionally coupled to a first recombination hotspot and a second heterologous DNA functionally coupled to a second recombination hotspot;

the first heterologous DNA and second heterologous DNA being adapted and configured within the recombinant genome for recombination.

35. The diploid fungal cell of claim 34, wherein the fungal cell is *Neurospora crassa*, *S. cerevisiae*, or *S. pombe*.

36. The diploid fungal cell of claim 34, wherein the diploid cell is a cell of a filamentous fungus, or a yeast cell, following karyogamy.

37. The diploid fungal cell of claim 34, wherein the first and second recombination hot spot are independently *Neurospora crassa cog*, 3' of *his-3* and 3' of *am* in *Neurospora crassa*, 3' of *his4* and 3' of *arg4* in *S. cerevisiae*, or within *ade6* in *S.*

pombe.

38. The diploid fungal cell of claim 34, wherein the first and second recombination hot spots are alleles of the *Neurospora crassa cog* recombination hotspot.

39. The diploid fungal cell of claim 38, wherein either or both of the first and second recombination hot spots are *Neurospora crassa* cog^{L}.

40. The diploid fungal cell of claim 38, wherein the heterologous DNA is located between the *his-3* gene and *cog*.

41. The diploid fungal cell of claim 40, wherein either the first or the second heterologous DNA is located between an inactive mutant of a *his-3* gene and *cog*.

42. The diploid fungal cell of claim 34, wherein the heterologous DNA is a promoter, is a regulatory sequence, is a noncoding sequence, encodes all or part of a subunit of an immunoglobulin, all or part of a heteromultimeric protein, all or part of a homomultimeric protein, all or part of a monomeric protein, all or part of a non-transcribed DNA sequence, all or part of a sequence that regulates the activity of a gene, all or part of a sequence transcribed into an RNA molecule lacking catalytic activity, all or part of a sequence transcribed into an RNA molecule having catalytic activity, or a combination thereof.

43. A haploid cell derived from the diploid fungal cell of claim 34, the haploid cell arising by meiosis and recombination, wherein the recombinant genome comprises a new sequence combination resulting from a crossover, a discontinuous conversion tract, or an error in recombination.

44. The diploid fungal cell of claim 34, wherein the fungal cell is *Neurospora crassa* of mating type *A* or type *a*.

45. The diploid fungal cell of claim 34, wherein the cell carries pairs of alleles of genetic loci that determines heterokaryon compatibility, whereby progeny of crosses of the cell can form heterokaryons in any combination of like mating type.

46. The diploid cell of claim 45, wherein the fungal cell is *Neurospora crassa* and each cell carries the same allele of the genetic loci *het-c, het-d, het-e, het-i, het -5, het-6, het-7, het-8, het-9*, and *het-10* .

47. The diploid fungal cell of claim 34, wherein the fungal cell comprises a forcing marker for a heterokaryon formed from the diploid cell.

48. The diploid fungal cell of claim 47, wherein the forcing marker comprises one or more auxotrophic mutations.

49. The diploid fungal cell of claim 48, wherein the forcing marker instills to a requirement for tryptophan, pantothenic acid, thiamine, or arginine.

50. The diploid fungal cell of claim 48, wherein the fungal cell is *Neurospora crassa* and the forcing marker is a mutation that inactivates a *trp-2* gene, a *pan-2* gene, a *thi* gene, or an *arg* gene.

51. The diploid fungal cell of claim 47, wherein the heterologous DNA codes for a subunit of a multisubunit protein.

52. The diploid fungal cell of claim 47, wherein the cell comprises two of a forcing marker for a heterokaryon formed from the cell

53. The diploid fungal cell of claim 52, wherein the heterologous DNA encodes subunits of a protein having a more than one type of subunit.

54. The diploid fungal cell of claim 47, wherein the cell comprises two distinct forcing markers for a heterokaryon formed from the cell.

55. The diploid fungal cell of claim 54, wherein the heterologous DNA encodes subunits of a protein having a single type of subunit.

56. The diploid fungal cell of claim 34, wherein the fungal cell comprises a genetic characteristic that suppresses heterokaryon incompatibility between strains of different mating type, whereby all combinations of progeny can form heterokaryons.

57. The diploid fungal cell of claim 56, wherein the fungal cell is *Neurospora crassa* and the cell carries the mutation *tol* , whereby heterokaryon incompatibility between strains of different mating type is suppressed.

58. The diploid fungal cell of claim 34, wherein the fungal cell is *Neurospora crassa* and the recombinant genome comprises an auxotrophic mutation in the *his-3 gene*.

59. The diploid fungal cell of claim 58, wherein the auxotrophic mutation is located towards the 3' end of the gene.

60. The diploid fungal cell of claim 58, wherein the fungal cell is

Neurospora crassa and comprises a non-complementing pair of *his-3* alleles.

61. The pair of diploid cells of claim 60, wherein the non-complementing pair is K26 and K480, whereby a heterokaryon carrying both alleles is unable to grow on media lacking histidine.

62. The diploid fungal cell of claim 58, wherein the fungal cell is *Neurospora crassa* and the cell carries cog^{L} and *lpl* sequences from the Lindegren strain.

63. The diploid fungal cell of claim 58, wherein the fungal cell is *Neurospora crassa* and the cell carries *rec-2 in both chromosome sets.*

64. The diploid fungal cell of claim 34, wherein the fungal cell is *Neurospora crassa* and comprises a gene conferring resistance to an agent for selecting against the presence of the whole plasmid.

65. The diploid fungal cell of claim 64, wherein the agent is p-flurophenylalanine.

66. The diploid fungal cell of claim 64, wherein the gene conferring resistance is *mtr*.

67. The diploid fungal cell of claim 34, wherein the fungal cell is *Neurospora crassa* and comprises a mutant gene to limit growth on plating media.

68. The diploid fungal cell of claim 67, wherein the mutant gene is *cot-1* C102t.

69. The diploid fungal cell of claim 34, wherein the recombinant genome comprises DNA sequences to enhance production, secretion, or both of a protein encoded by the heterologous sequence.

70. A plasmid comprising a truncated *Neurospora crassa his-3* gene and a *Neurospora crassa* recombination hot spot functionally coupled to a heterologous DNA, a multiple cloning site 3' to the *his-3* gene, and a marker gene;

the plasmid being adapted and configured for transfection of a *Neurospora crassa* cell.

71. The plasmid of claim 70, wherein the *his-3* gene from *Neurospora crassa* is truncated at the 5' end.

72. The plasmid of claim 71, wherein the plasmid comprises the truncated *his-3* gene and further sequence of the *Neurospora crassa* genome extending 3' of the *his-3* gene.

73. The plasmid of claim 72, wherein the heterologous DNA is inserted in the further sequence of the *Neurospora crassa* genome extending 3' of the *his-3* gene.

74. The plasmid of claim 72, wherein the further sequence of the *Neurospora crassa* genome extending 3' of the *his-3* gene comprises or has been modified to comprise a multiple cloning site.

75. The plasmid of claim 74, wherein the multiple cloning site is not in a DNA sequence coding for an essential cellular function.

76. The plasmid of claim 70, wherein the plasmid is a modified pBM60

plasmid, a modified pRAUW122 plasmid, or a modified pFJB1 plasmid.

77. The plasmid of claim 70, wherein the plasmid is capable of replicating in *Escherichia coli* cells.

78. The plasmid of claim 70, wherein the marker gene is a selectable marker gene.

79. The plasmid of claim 78, wherein the selectable marker gene is an *hph* gene, which confers resistance to hygromycin.

80. The plasmid of claim 70, further comprising a promoter permitting expression in *N. crassa.*

81. The plasmid of claim 80, wherein the promoter permitting expression in *N. crassa* which is functionally coupled to the marker gene.

82. The plasmid of claim 80, wherein the promoter is a promoter for expression and control of expression of the heterologous DNA, the promoter being functional in *Neurospora crassa.*

83. The plasmid of claim 70, wherein the marker gene confers antibiotic resistance to *E. coli* cells.

84. The plasmid of claim 70, wherein the truncated *his-3* gene comprises a majority of the *his-3* gene, but lacks a portion of the sequence at the 5' end of the gene.

85. The plasmid of claim 84, wherein the portion of the sequence at the 5' end

of the gene is about 30 to about 300 nucleotides, such that a start codon starting at nucleotide 687 of SEQ ID NO 1 is excluded from the plasmid.

86. The plasmid of claim 84, wherein the truncated *his-3* gene comprises a stop codon of the *his-3* gene.

87. The plasmid of claim 70, wherein the truncated *his-3* gene is from a *his-3*$^{+}$ or a *his-3* mutant strain of *N. crassa.*

88. The plasmid of claim 87, wherein the *his-3*$^{+}$ strain of *N. crassa* is St Lawrence 74A wild type, Lindegren wild type, or is the *his-3* mutant K26 derived from Lindegren, K480 derived from the Emerson *a* wild type, or strain carrying K458 or another strain that complements either K26 or K480.

89. The plasmid of claim 70, further comprising a DNA sequence that enhances production, secretion, or both of a protein encoded by the heterologous sequence.

90. The plasmid of claim 89, wherein the heterologous DNA codes for a messenger RNA and the DNA sequence that enhances tags the messenger RNA transcribed from the heterologous DNA for export of the protein product.

91. The plasmid of claim 70, wherein the *Neurospora crassa* recombination hot spot is a *cog* recombinator.

92. The plasmid of claim 91, wherein the *cog* recombinator is a *cog*^{L} allele.

93. The plasmid of claim 92, wherein the *cog*^{L} allele is from the Lindegren

wild type.

94. The plasmid of claim 93, wherein the cog^L allele is from about nucleotide 5412 to about nucleotide 6831 of SEQ ID NO 1.

95. The plasmid of claim 70, further comprising a DNA sequence within a *lpl* gene and providing homology downstream of *cog*.

96. The plasmid of claim 95, wherein the DNA sequence within the *lpl* gene is from about nucleotide 6831 and 3' for about several hundred base pairs of SEQ ID NO 1.

97. The plasmid of claim 70, wherein the marker gene provides for positive selection.

98. The plasmid of claim 97, wherein the marker gene confers hygromycin resistance.

99. The plasmid of claim 98, wherein the marker gene is hph^R.

100. The plasmid of claim 70, wherein the marker gene provides for negative selection.

101. The plasmid of claim 100, wherein the marker gene confers p-fluorophenylalanine sensitivity.

102. The plasmid of claim 101, wherein the marker gene is mtr^+.

103. A method of preparing diversified DNA comprising the steps of:

constructing a plurality of fertile strains of a fungus, each strain comprising a distinct heterologous DNA to be diversified, each heterologous DNA being functionally coupled to a recombination hot spot;

mating a pair of the strains to form a dikaryon;

establishing a diploid cell from the dikaryon; and

inducing the diploid cell to undergo meiosis to produce a haploid spore, the meiosis comprising gene conversion, crossing over, errors in recombination, or a combination thereof;

whereby the heterologous DNA is diversified.

104. The method of claim 103, further comprising the step of isolating the diversified heterologous DNA.

105. The method of claim 103, further comprising the step of detecting diversification of the heterologous DNA.

106. The method of claim 103, further comprising the step of isolating a gene product of the diversified heterologous DNA.

107. The method of claim 103, further comprising the step of detecting a gene product of the diversified heterologous DNA.

108. The method of claim 103, wherein each haploid spore comprises one of four products of a mitotic division

109. The method of claim 103, wherein the fungus is *N. crassa* and each diploid cell produces eight spores in four spore pairs.

110. The method of claim 103, wherein at least one of the fertile strains has an auxotrophic mutation.

111. The method of claim 110, wherein each of the fertile strains has a distinct auxotrophic mutation.

112. The method of claim 103, further comprising selecting progeny for a recombination event in a gene more distant from the hot spot than the heterologous DNA;

whereby such selection ensures that the entire heterologous DNA was covered by a conversion tract.

113. The method of claim 103, wherein mating comprises combining strains pairwise or in other combinations to form one or more panels of strains that can be combined in pairwise or higher order combinations as heterokaryons.

114. The method of claim 103, wherein the fungus is *Neurospora crassa* and the step of constructing comprises transfecting the strains with a plasmid comprising a truncated *Neurospora crassa his-3* gene and a *Neurospora crassa* recombination hot spot functionally coupled to a heterologous DNA, a multiple cloning site 3' to the *his-3* gene, and a marker gene;

the plasmid being adapted and configured for transfection of a *Neurospora crassa* cell.

115. The method of claim 103, wherein the fertile strain comprises a haploid cell comprising a recombinant genome, the recombinant genome comprising a heterologous DNA functionally coupled to a recombination hotspot; the haploid fungal

cell being capable of being converted to a diploid fungal cell; the heterologous DNA being adapted and configured within the recombinant genome for recombination in the diploid fungal cell.

116. The method of claim 103, wherein the diploid fungal cell comprises a recombinant genome, the recombinant genome comprising a first heterologous DNA functionally coupled to a first recombination hotspot and a second heterologous DNA functionally coupled to a second recombination hotspot;

the first heterologous DNA and second heterologous DNA being adapted and configured within the recombinant genome for recombination.

117. A diversified DNA molecule made by a method comprising the steps of:

constructing a plurality of fertile strains of a fungus, each strain comprising a distinct heterologous DNA to be diversified, each heterologous DNA being functionally coupled to a recombination hot spot;

mating a pair of the strains to form a dikaryon;

establishing a diploid cell from the dikaryon; and

inducing the diploid cell to undergo meiosis to produce a haploid spore, the meiosis comprising gene conversion, crossing over, errors in recombination, or a combination thereof;

whereby the heterologous DNA is diversified.

118. An isolated DNA molecule comprising a sequence of a recombination hotspot *cog* of *Neurospora crassa*.

119. The isolated DNA molecule of claim 118, wherein the cog sequence comprises nucleotides from about 5412 to about 6831of SEQ ID NO: 1.

120. A kit for preparing diversified DNA comprising:

an fertile strain of fungus adapted and configured for housing a recombinant genome;

a plasmid for preparing the recombinant genome comprising a recombination hotspot from the fungus strain, the plasmid being adapted and configured to receive heterologous DNA in a position functionally coupled to the recombination hot spot.

121. A method of preparing a strain of a fungus comprising the steps of:

transfecting a first fungal cell having a first allele of a gene with a first vector including a first heterologous DNA and a second allele of the gene and establishing a first heterokaryon, the first and second allele each encode a defective version of the gene and are complementary alleles;

growing the first heterokaryon to establish a first homokaryon containing the second allele of the gene and the first heterologous DNA;

transfecting a second fungal cell having a third allele of the gene with a second vector including a second heterologous DNA and a fourth allele of the gene and establishing a second heterokaryon; the third and fourth alleles each encode a defective version of the gene and are complementary alleles;

growing the second heterokaryon to establish a second homokaryon containing the fourth allele of a gene and the second heterologous DNA; and

crossing the first and second homokaryons to establish the strain of the fungus.

122. The method of claim 121, wherein the first and third alleles are the same allele.

123. The method of claim 121, wherein the second and fourth alleles are non-complementing alleles.

124. The method of claim 121, wherein the fungus is *Neurospora crassa*.

125. The method of claim 124, wherein the auxotrophic mutant is a *his-3* auxotrophic mutant.

126. The method of claim 125, wherein the first transfected fungal cell comprises *his-3* K26 and *his-3* K458, and the second transfected fungal cell comprises *his-3* K480 and *his-3* K458

127. The method of claim 121, wherein the non-complementing pair of alleles is K26 and K480, whereby a heterokaryon carrying both alleles is unable to grow on media lacking histidine.